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Abstract

Augmented reality (AR) carries with itself a range of fascinating features which could be implemented by firms across different industry sectors to enhance user experience and add business value. The acceptance of AR can be viewed from two perspectives, viz. the acceptance by the user and acceptance by firms as a technology. However, the research gap observed is noteworthy. For an e-commerce firm, while there has been ample amount of research on acceptance of AR, there seem to be insufficient information on why augmented reality has not been adopted by these firms. In this research-in-progress paper, using the Technology, Organization and Environment using Tornatzky and Fleischer's Technology-Organization-Environment model (TOE) as the guiding lens, we first theorize the factors significant for the acceptance of AR technology by e-commerce firms. Next, we intend to test the theorized relationships via a field survey of e-commerce firm personnel who are familiar with AR technology. Through this study, we will offer deeper understanding into the TOE framework for the adoption of AR technologies by e-commerce firms. Further, on the practical front, the study will help the e-commerce firms to strategize and focus on specific factors to implement augmented reality effectively.

Keywords: Augmented Reality, E-Commerce, TOE Framework, Industry Adoption

1. INTRODUCTION

Augmented Reality (AR) or in other words enhanced reality, is one of the emerging technologies which has increasingly gained attention over last few years. The concept of AR refers to combining the real world entities and computer-generated digital information into the user's view of the physical real world in such a way that they appear as one environment. The digital information is a layer overlapping the real world view. The concepts of AR has evolved so much over years that AR can be considered a central technology in the paradigm shift from desktop-based interaction towards ubiquitous computing, enabling smart services "anytime, anywhere". Overall, the new realm of augmenting the physical world with digital artefacts and information holds the potential to revolutionize the way in which information is accessed and presented. AR integrated with other technologies such as gesture recognition, wearable technologies and Internet of Things (IoT) could bring out the innovativeness of the product, improve operational efficiencies and also help in understanding consumer behaviour.

While AR has been successfully implemented in the gaming industry (Christian et al., 2014), other sectors such as manufacturing, health care, sports and education are exploring the possibility of using AR innovatively in their business. E-commerce is one such industry for which AR holds huge potential. Well known innovative e-retailers like Tobi, J C Penney, Barbie, Zawara etc. in the recent times have integrated and tested the virtual dressing room software with their web application to give the online shoppers an in-store experience (Ju-Young and Kang, 2013). The virtual dressing room, allows a user to try out the apparels and accessories virtually, flip through the variety and help them make a purchase while users are in the comfort of their home. Also, IKEA, the world's largest furniture retailer has utilized the concept of mobile AR for their mobile app (Reuters, 2008). It not only helps customers to shop online but also allows the user to check how well a product like furniture or a bed lamp fits in their home layout. Zugara, an AR application development company based out of California US, has provided applications for the above mentioned e-retailers and many more including Nordstrom, Samsung, Aramark etc. explains not only does application helps in giving an enhanced in-store experience, but also helps in gathering data about user's shopping behaviour and in turn helps in data analytics. Thus, the e-retails can use the data to understand user preferences.

The e-commerce industry has been growing at an explosive pace over the past few years with worldwide Business to Consumer (B2C) e-commerce sales amounting to 1.2 trillion USD in 2013 (Statista, 2016). Current e-commerce statistics state that 40% of worldwide Internet users have bought products online via different channels like desktops, mobile phones, tablets etc. which converts to 1 billion online users (Statista, 2016). Major players in e-commerce industry like Amazon, Alibaba, JD compete among themselves as well as with geography specific local players to gain market share. Firms with a motive to gain competitive advantage are exploring and adopting new technologies which help them retain customers, increase impulsive buying among consumers, reduce the cost and increase the profit margin. Surprisingly, though these players have explored the opportunity underlying in AR (Olsson et al. 2012) none of them have commercially induced it in their value chain. Quantitative empirical studies on AR and its adoption for e-commerce are relatively few and most of them are limited to analysing it from an end user's perspective (Olsson et al. 2012). To the best of our knowledge, there is no empirical study to understand the facilitators for AR adoption by the e-commerce firms. To fill these research gaps, using the Technology–Organisation–Environment (TOE) framework (Tornatzky and Fleischer, 1990) as the guiding theoretical lens, we seek to explore the key factors that influence the adoption of AR technology by the e-commerce industry. Our primary research question is:

RQ: What are the key factors that influence a firm to adopt AR as a technology for e-commerce?

The TOE framework, which has emerged as a useful theoretical lens for understanding technology adoption, has been mostly used in the context of business firms. Moreover, TOE framework has been used for the adoption of technologies such as Customer-based IOS, Open Systems, EDI, RFID,

Enterprise systems, E-Business, We apply the TOE framework for understanding the facilitators of AR adoption in e-commerce industry. In doing so, we extend the applicability of the TOE framework to new technologies.

2. THEORY & HYPOTHESIS

2.1 Augmented Reality

User experience seeks to promote rich, engaging interactions between users and systems. In order for this experience to unfold, the user must be motivated to initiate an interaction with the technology (O'Brien, 2010). Realizing the need to understand the user needs and motivations, research on AR has explored user motivations, both hedonic and utilitarian, in the context of user engagement with online shopping. Hedonic motivations are based on experiences of user while interacting with the technology and utilitarian motivations are based on interests of utility during the interaction. For example, O'Brien (2010) explored utilitarian factors such as gratification and value along with hedonic factors such as aesthetics and enjoyment for user engagement with online shopping. AR as technology has the capability to cater to users who are hedonistically motivated. The reason behind providing these experiences like AR to user is to instigate the hedonic aspects of consumer behaviour. Activating hedonic aspects of a user enhances the decision making and increases the experiential value. For example, Huang et al. (2013) discusses the role of hedonic motivations (such as playfulness, involvement in an activity, sense of control, enjoyment and temporal disposition) for persuading the users to make purchases. Alternatively, Wells et al. (2005) showed the significance of utilitarian motivation of a consumer, over hedonic motivations for a conventional e-commerce portal. Wells et al. (2005) in their research explains, most e-retailer portals are designed for utilitarian consumers (rationale and goal oriented consumers) who visits the online portal with a clear idea in mind of the product to be purchased.

Though past research has explored the consumer's perspective and the need to focus on utilitarian and hedonic motivations for the acceptance of AR technology, past studies have not explored the industry perspective and reasons for not implementing AR in their e-commerce business.

Our research aims to understand the key factors which would influence an e-commerce firm to adopt AR. With a positive trend in consumer acceptance we try to analyse acceptance of AR from a firm's perspective. To analyse the perspective of a firm, we have considered Tornatzky and Fleischer's Technology – Organization – Environment model (TOE) (1990). The model analyses a firm from three different dimensions of technology, organization and environment. Each of these dimension cover a wide range of constructs to understand acceptance of technology for the firm.

2.2 Technology-Organization-Environment (TOE) Framework

In this research, using Tornatzky and Fleischer's Technology-Organization-Environment framework (TOE) (1990) as a theoretical lens, we seek to understand the role of technology, organization and environment in influencing the adoption of Augmented Reality (AR) by e-commerce firms to (Baker, 2011). Tornatzky and Fleischer (1990) through their TOE framework state that the decision to adopt technological innovation by a firm is based not only on the technology, but is also dependent on the organisational and environmental contexts. In the TOE framework, the technological context describes the relevant technologies available to the firm. The organisational context describes some of the organisational characteristics and resources such as slack, size, structure etc. The environmental context consists of the environmental characteristics in which the firm conducts its business. These three contextual factors collectively influence a firm's decision to adopt an innovation, and consequently firm performance. Tornatzky and Fleischer (1990) discuss the adoption and implementation of technologies from both consumer and firm perspectives.

Using TOE framework as the grounding theory, several studies have found significant association of all or some of the contextual factors with technology adoption and consequently performance such as e-business (Zhu et al., 2003), Electronic Data Exchange (EDI) (Kuan and Chan, 2001) and IS applications (Thong, 1999). The researchers who used the TOE framework to evaluate the adoption of new technologies by firms have assumed unique factors or measures based on the technology under study. The TOE framework has not been used to study the adoption of AR by e-commerce firms in the past. Hence, the factors we have chosen are assumptions based on the past experience of the authors. Additional factors can be evaluated and study as part of further research.

Firms need to carefully evaluate opportunities for AR adoption based on their relevance, benefits and the capability to adopt. Hence, it is important to assess the above mentioned parameters to determine the adoption capability of the firm (Chau & Kar, 1997). In this research, grounding our work on TOE framework, we aim to explore the technology, organization and environment contextual factors that influence the adoption of AR by e-commerce firms.

The research model for this study is depicted in Figure 1.

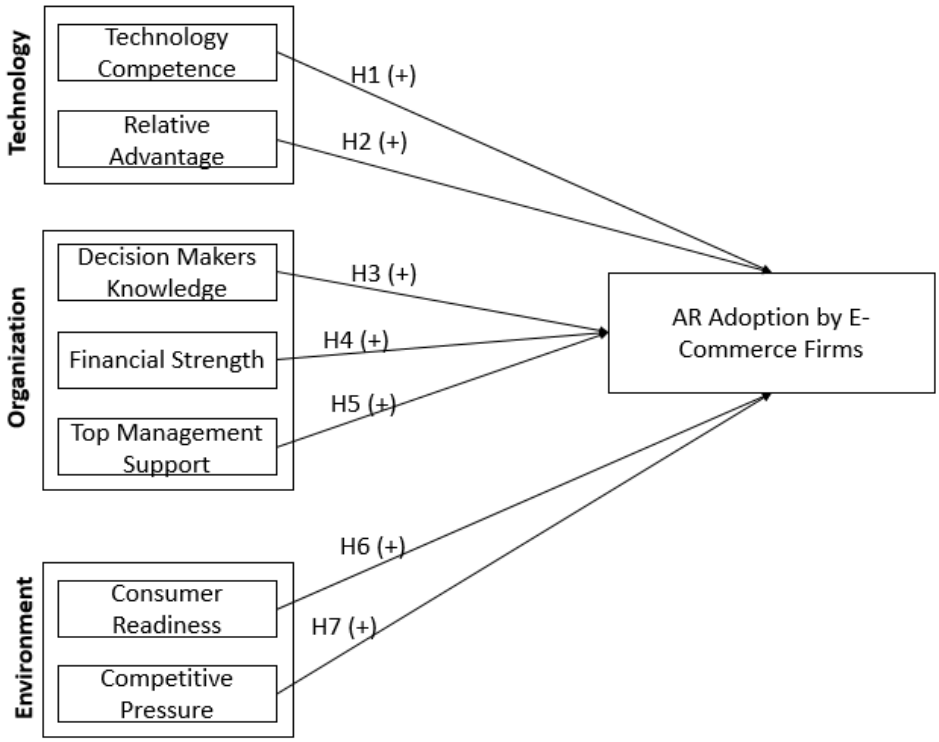

Figure 1: Research Model for adoption of AR by e-commerce industry based on TOE framework

2.2.1 Technology

Technological context includes the internal (technologies used by the firm) and external (technologies existing in the market) technologies which are relevant to the firm. The existing technologies in the market influence the adoption of new technologies such as AR as they enable firms to evolve and adapt to the changing markets. On the other hand, the existing technologies that are adapted by the firm set context in terms of capabilities to adopt to new technologies (Baker, 2011). Innovations can be classified into three categories – incremental changes (enhancements to existing product or process), synthetic changes (combination of existing technologies or ideas to create new processes or products) and discontinuous changes (changes that create completely new products and services (Chau & Kar, 1997). The capabilities that firms need to adapt to new technologies depend on the type of innovation in question. The two significant technological factors in the context of AR are technology

competence of the firm and relative advantage that the technology offers. AR in the context of e-commerce is a type of synthetic change which firms can leverage to differentiate their products or service.

Technology Competence

Technology competence is one of the important determinants or drivers of the adoption or intention to innovate and use new technologies. It refers to the firm's technical capabilities including both IT infrastructure capabilities and IT human resource capabilities (Zhu et. al, 2005). Firms like Uber. Apple, Netflix and Toyota have been able to thrive the era of economic transformation by leveraging on their technical competence (Halal, 2012 & Walker, 2016). Technology competence can be obtained by comparing the IT expertise of the firm against competitors or industry benchmarks. The higher the technology competence of a firm the more probable it is that they would accept the new technologies. (Zhu et. al, 2002). This leads to the following hypothesis:

H1 - The level of technology competence of a firm is positively associated with the adoption intention of AR by e-commerce firms.

Relative Advantage

Relative advantage is the degree to which an innovation is considered to be beneficial than competition (Thong, 1999). The perceived benefits of AR will provide an incentive for technology adoption. Past research indicates a positive relationship between the perceived advantage of using the technology over competition (relative advantage) and adoption of IS innovations. (Ramdani et. al., 2009). AR reality offers several benefits to customers and enhances shopping experience of users when used in an e-commerce setting. AR saves time taken to browse the products, trying them on if required and makes shopping convenient for e-shoppers (Kang, 2014) Information technology is known to be a power tool to gain sustainable competitive advantage (Colgate, 1998). In today's highly competitive market, technologies such as AR offer firms the relative advantage when adopted. This leads us to our next hypothesis:

H2 – The relative advantage of AR is positively associated with adoption intention of AR by e-commerce firms.

2.2.2 Organization

Many organizational characteristics influence the adoption of new innovations and technologies. Baker (2011) identifies characteristics such as firm size, scope, firm's structure etc. These factors influence the adoption of innovation as they have the capabilities to eliminate the internal friction in the adoption of new technologies. The three significant organizational factors are decision makers' knowledge, the financial strength of the firm and the support from the top management.

In any firm the top influencers play a powerful role in making major organizational changes. Adoption of innovation is one such change that can be influenced by these influencers. Top executives achieve this by – communicating the clear role and value of technology to meet firm's strategy, driving a clear message to other external parties about the value of innovation within the firm (Angeles, 2014).

Decision Makers AR Knowledge

When assessing new technologies firms often assess the necessary skills and technical knowledge and decide if they want to adopt the technology or postpone the adoption to a later date when the knowledge barriers fall down. The decision makers knowledge and innovativeness play a key role in

the adoption of a technology, the greater these attributes are it is more likely that a firm will adopt the new technology (Thong, 1999). Hence, we hypothesize,

H3 – The decision makers' knowledge on AR is positively associated with the adoption intention of AR by e-commerce firms.

Financial Strength

The financial strength of a firm is another factor which influences the adoption of new technologies. This could be a positive or negative influence as there have been arguments about the high barriers of innovation adoption might also motivate firms to take innovations more seriously enable it to propagate within a firm (Kraemer, 2006). Hence, we hypothesize,

H4 – The financial strength of a firm is positively associated with the adoption intention of AR by e-commerce firms.

Top Management Support

Past research has highlighted the importance of the influence of top management on the adoption of new technologies (Grover, 1999). Top management has the ability to positively influence new technology adoption by articulating a vision and reinforcing value through the firm (Ramdani et al., 2009). In general, in a firm where the top management is highly enthusiastic and innovative welcome new technologies and are often willing to take the risk. They play an important role in securing resources and planning for implementation (Grover, 1999). For example, the management of 3M placed little emphasis on top-down planning and nurtured ideas from frontline engineers and sales executives, which enabled the firm to be profitable by adapting to promising new technologies (Ghoshal, 1995). Hence, we hypothesize,

H5 – Top management support is positively associated with the adoption intention of AR by e-commerce firms.

2.2.3 Environment

External factors such as the type of regulations, structure of the industry and the type of service providers available who are capable of implementing the technology. Industry structure is an important influencer in the adoption of new technologies as the rate of adoption depends on the growth rate of the industry. The faster the industry grows the more likely are firms to adopt to technologies (Baker, 2011). The extent of competition within the external environment also significantly influences adoption of new innovation, intense competition leads to higher adoption rates as firms try to gain competitive advantage by leveraging technology to catch up with competition (Thong, 1999).

Another important factor that influences the adoption of technologies is stakeholder pressure. External stakeholders include multiple parties such as competitors, customers, government, suppliers etc. (Angeles, 2014). As AR is a customer facing technology, consumer readiness becomes an important factor for adoption of technology (Grover, 1993). Hence, the two significant factors in the context of AR are consumer readiness and competitive pressure.

Consumer Readiness

Consumer readiness is combination of consumer willingness to engage with new technologies and the availability of support technology to the customer (Zhu et al., 2003). Consumer readiness is a significant factor that may encourage firms to implement Augmented Reality (Kevin et. al, 2003) In this case, there are several papers which confirm the user acceptance of the technology, hence, we

believe that this is an important factor which will influence the adoption of AR (Kang, 2013; Brynjolfsson et al., 2013; Panos et al., 2013; Zhu, 2008). Hence, we hypothesize,

H6 – The consumer readiness is positively associated with the adoption intention of AR by e-commerce firms.

Competitive Pressure

Competitive pressure has been recognized as one of the parameters that firms consider while deciding the adoption of new technologies (Kevin et. al, 2003). We hypothesise that this is true in the case of AR too. AR adoption might enable firms to change the rules of competition. The structure of the industry and the number of firms who are already using the technology influences adoption of AR as firms would act fast to ensure that they stay ahead of competition. The more firms are aware of what the competition is doing However, to benefit from the trends of competition, firms need to constantly scan the competitive environment to be aware and stay ahead of competition. This leads to our next hypothesis,

H7 – Competitive pressure is positively associated with the adoption intention of AR by e-commerce firms.

3. PROPOSED METHODOLOGY AND FUTURE WORK

We are using survey methodology for testing the proposed hypotheses. Validated scales from existing literature will be adapted to the research context to formulate the questionnaire. To measure the items, we used a 5-point Likert scale. Questionnaires so formulated were distributed to middle and senior level managers of ecommerce companies. An initial mailing list was prepared and email invitations were sent to nearly 168 e-commerce companies in India and Singapore. An online link to the survey was attached to the email invitation, along with a letter which informed the participants of the voluntary nature of survey participation and assured them of confidentiality. A follow-up reminder was sent a week later. Initial analysis with the collected data shows that the data has satisfactory factor structure and psychometric properties. We intend to do the detailed analysis to test the proposed hypotheses within the next few weeks and believe that we should have the final results ready for presentation at PACIS 2015 conference.

4. EXPECTED CONTRIBUTION

This research-in-progress paper is expected to make two major contributions. First, in this research, grounding our work on TOE framework, we have explored significant factors for the adoption of AR technologies by ecommerce firms. Future research can build further on TOE framework to add new factors and extend the theoretical framework. Second, on the practical front, the results of the study will be useful for firms to strategize and focus on factors and capabilities which will influence AR adoption to gain sustainable competitive advantage.

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